4 December 2013
ICA-RUS workshop
@ TIME24 Building

Integrated analyses of climate risk management in ICA-RUS

National Institute for Environmental Studies
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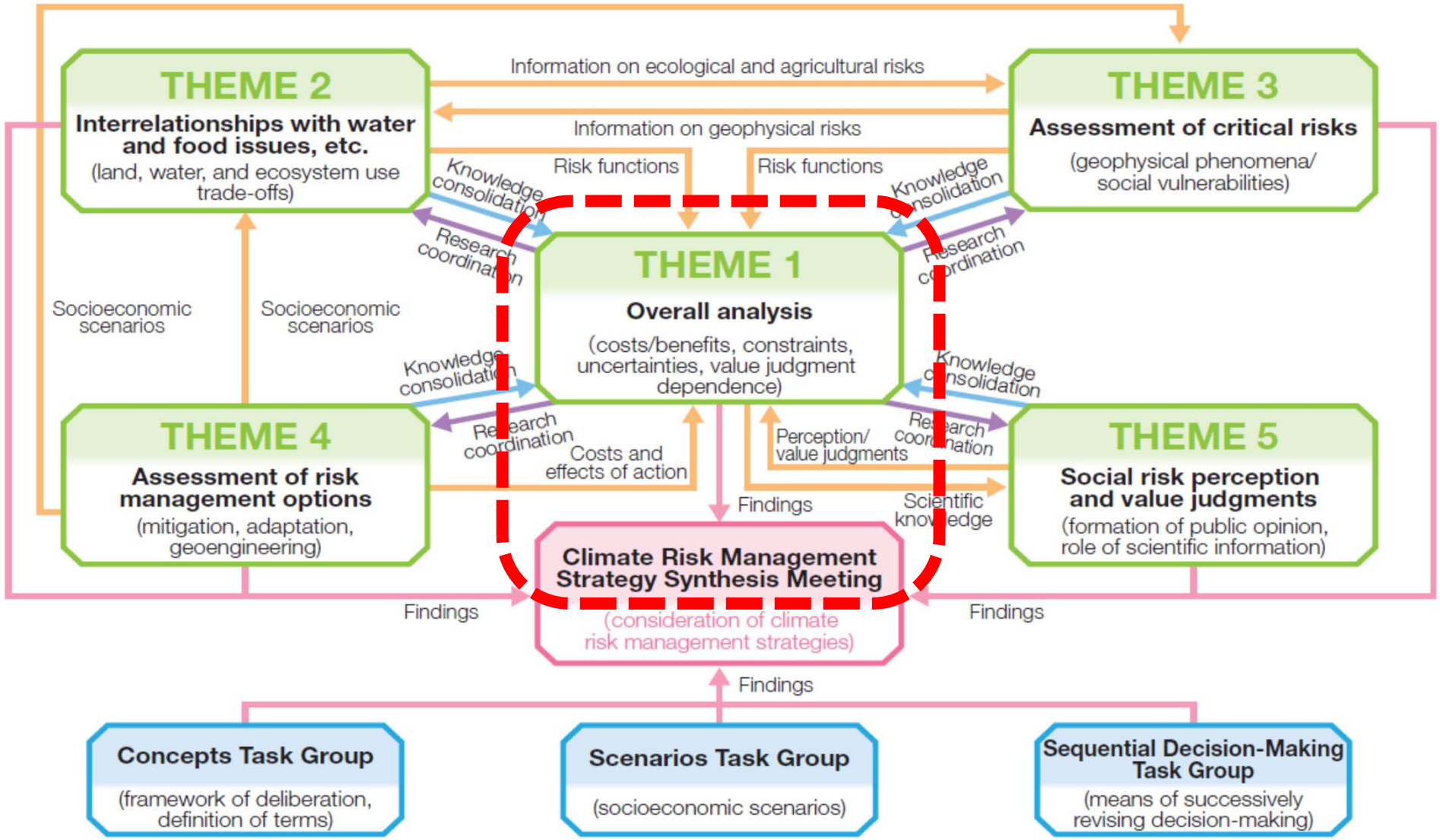
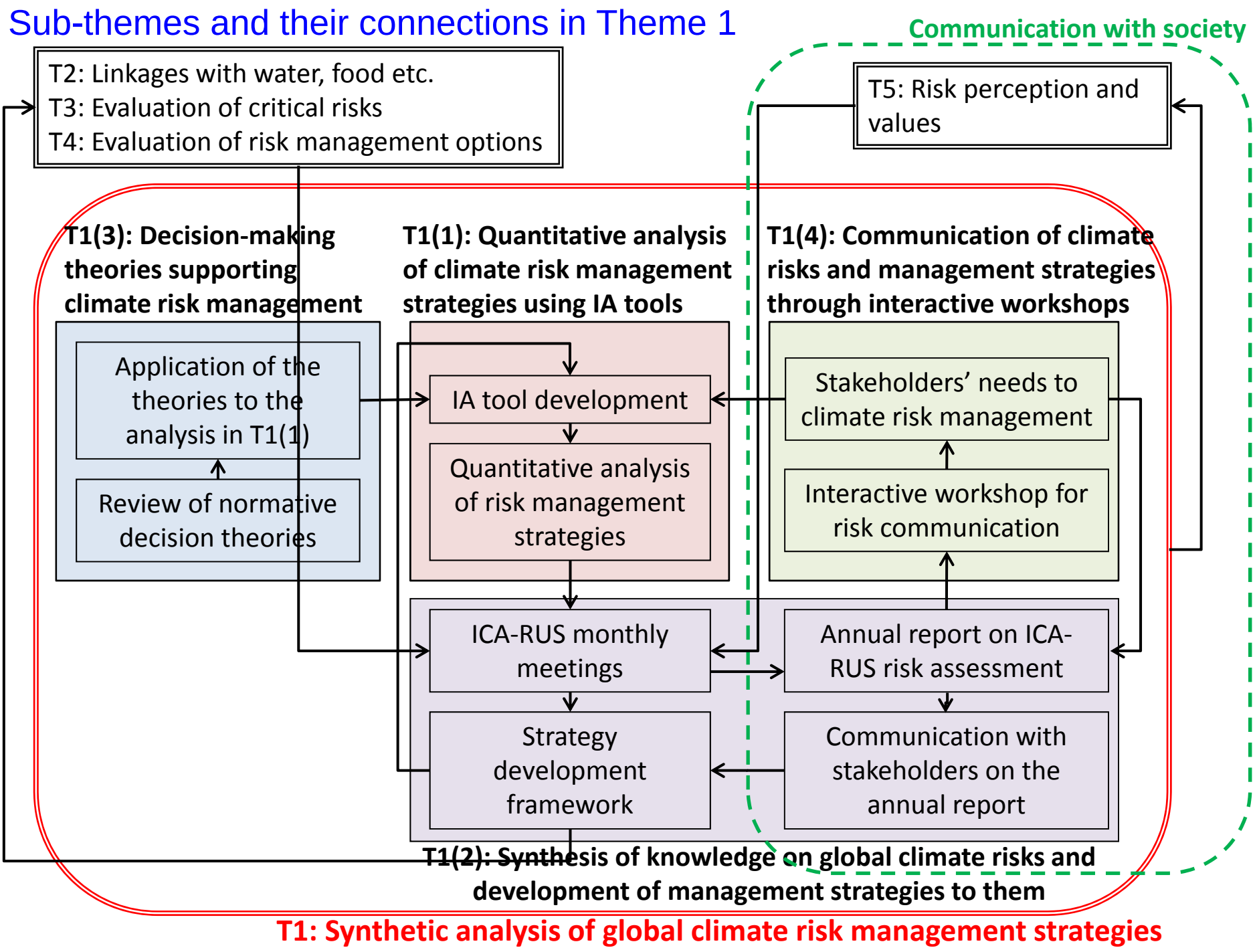
(on behalf of S-10-1(1) team)

Research system of ICA-RUS project



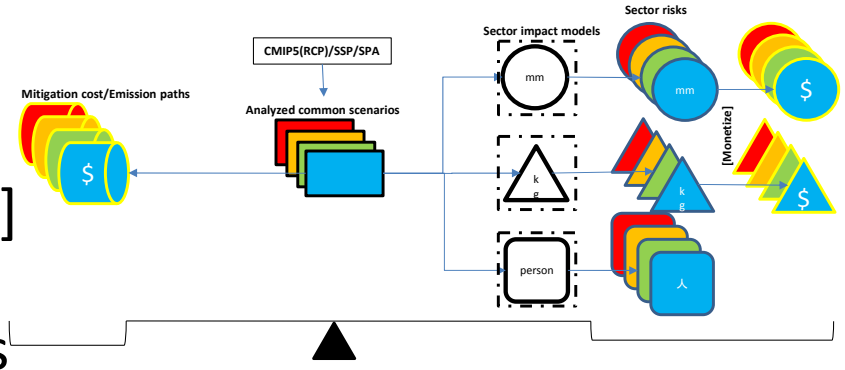

Sub-themes and their connections in Theme 1
Communication with society
T2: Linkages with water, food etc.
T3: Evaluation of critical risks
T4: Evaluation of risk management options
T5: Risk perception and values
T1(3): Decision-making theories supporting climate risk management
T1(1): Quantitative analysis of climate risk management strategies using IA tools
T1(4): Communication of climate risks and management strategies through interactive workshops
Application of the theories to the analysis in T1(1)
Review of normative decision theories
IA tool development
Quantitative analysis of risk management strategies
Stakeholders' needs to climate risk management
Interactive workshop for risk communication
ICA-RUS monthly meetings
Annual report on ICA-RUS risk assessment
Strategy development framework
Communication with stakeholders on the annual report
T1(2): Synthesis of knowledge on global climate risks and development of management strategies to them
T1: Synthetic analysis of global climate risk management strategies

Main tasks of Sub-theme 1

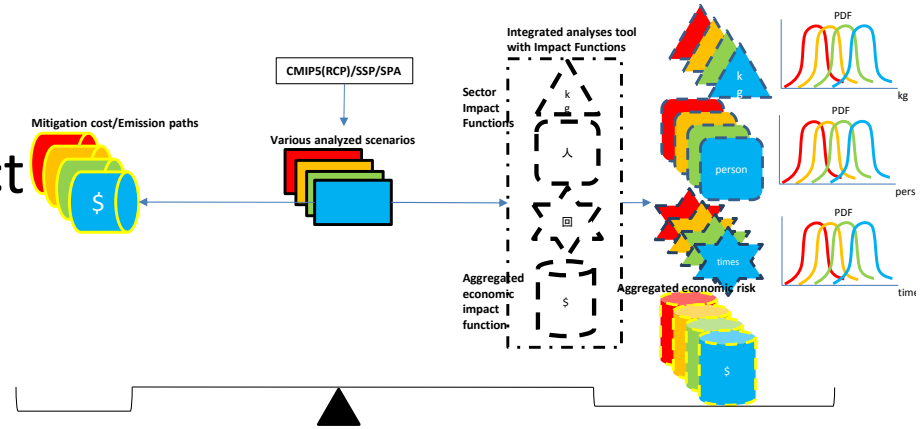
- Improvement of integrated analyses tool
  - Extension of Impact Functions (Simplified impact analyses model)
  - Examination of applicability of pattern scaling
  - Improvement of simple climate model
  - Modification of tool interface for probabilistic impact analyses
- Quantitative analyses of risk management strategies using the integrated analyses tool
  - Probabilistic analyses considering uncertainties in emission scenario, climate projection, etc.
  - Comprehension of needs in international negotiation for proposing sensible strategies

2 way approach for quantitative analysis of risk management strategies in ICA-RUS project

- End-to-end scenario analyses
  - Sector risk analyses using full-scale impact model based on limited number of mitigation scenarios [Theme 2 and Theme 3]
  - Exploration of policies to achieve the assumed mitigation scenarios in the sector risk analyses. [Theme 4]



- Integrated analyses tool
  - Development of 'Impact Functions' for each sector impact [Theme 2 and 3]
  - Probabilistic analyses of multi-sector climate risks [Theme 1]
  - Mitigation policy analyses [Theme 4]

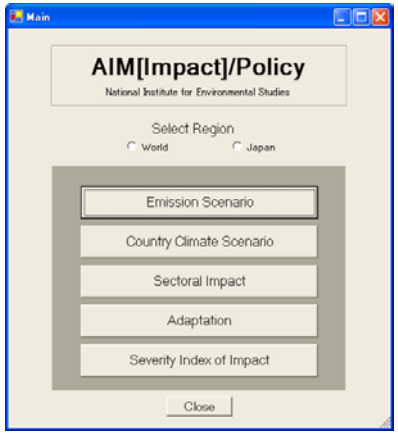


Integrated analyses tool for policy support: AIM/Impact [Policy]

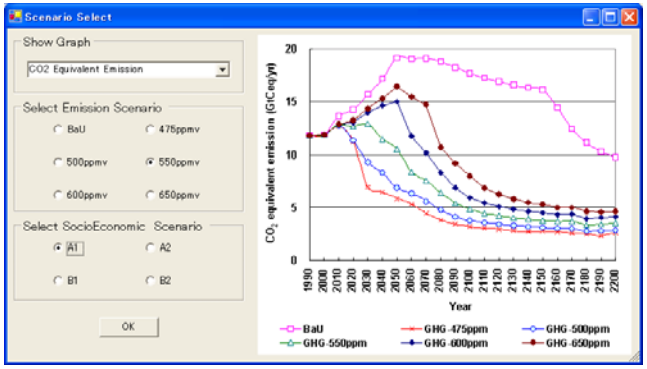
- Purpose
  - Comprehensive analysis and assessment of global warming control targets such as stabilization of GHG concentrations, economically efficient emissions paths to realize those targets, and the impacts and risks under the sets of those targets
- Input
  - Future scenarios of Population, Economic growth, Technology improvement, energy reserve, etc.
  - Assumption on constraints (Limits of GHGs emission/concentration, temperature increase, and SLR), etc.
- Output
  - Time-series of GHGs emission, GHGs concentration, temperature, precipitation, SLR, sector-wise impacts, etc.
- Model components
  - Dynamic optimization model linked with simple climate model for exploring an optimal emission trajectory
  - Database-type impact assessment model
  - Burden sharing model for estimating country-wise GHGs emission reduction necessary for achieving global emission reduction target
- Reference
  - Hijioka, Y., T. Masui, K. Takahashi, Y. Matsuoka, H. Harasawa (2006) : Development of a support tool for greenhouse gas emissions control policy to help mitigate the impact of global warming. *Environmental Economics and Policy Studies*, **7(3)**, 331-346.

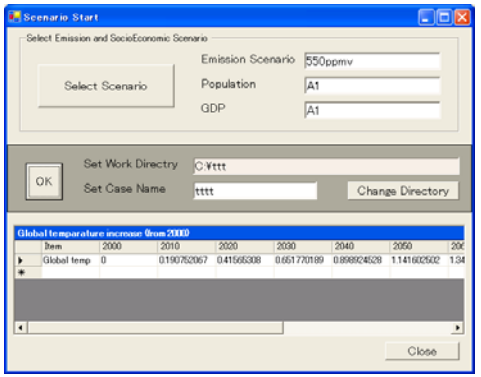
Snapshots of AIM/Impact [Policy]

(0) Top page

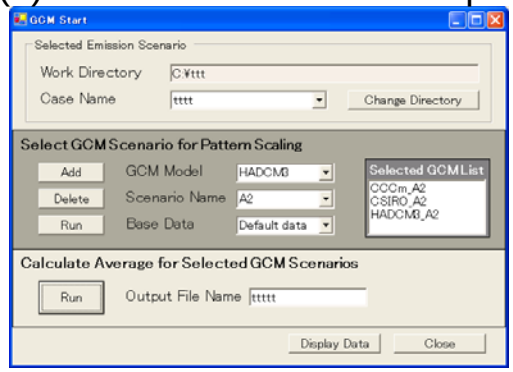


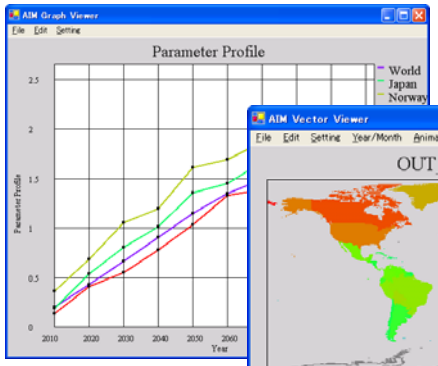
(1) Scenario selection



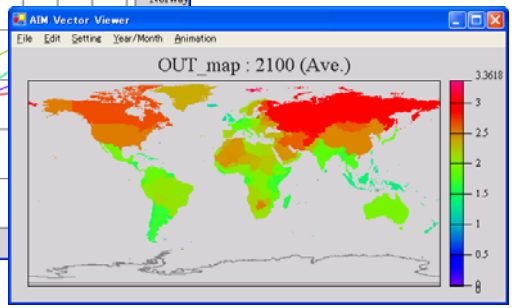


(2) GCM selection / Climate projection

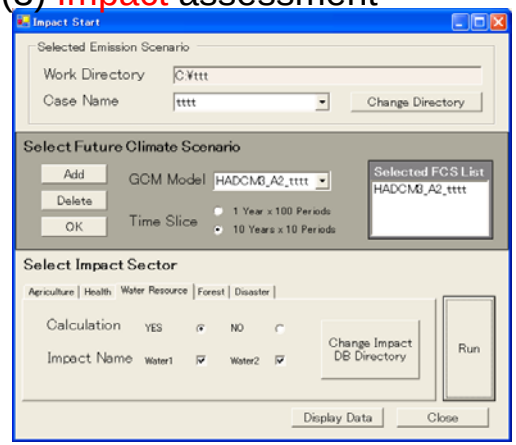


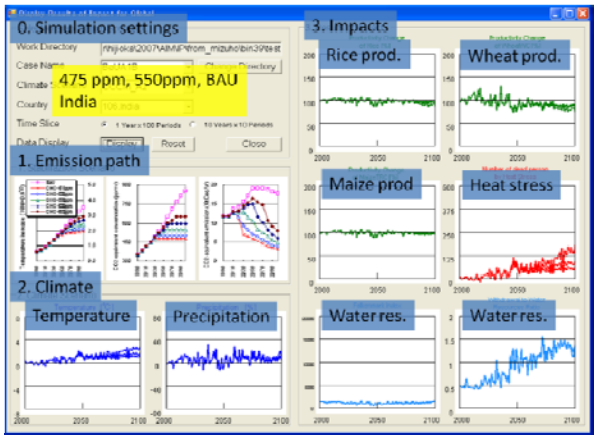


Ex.)
Temperature increase



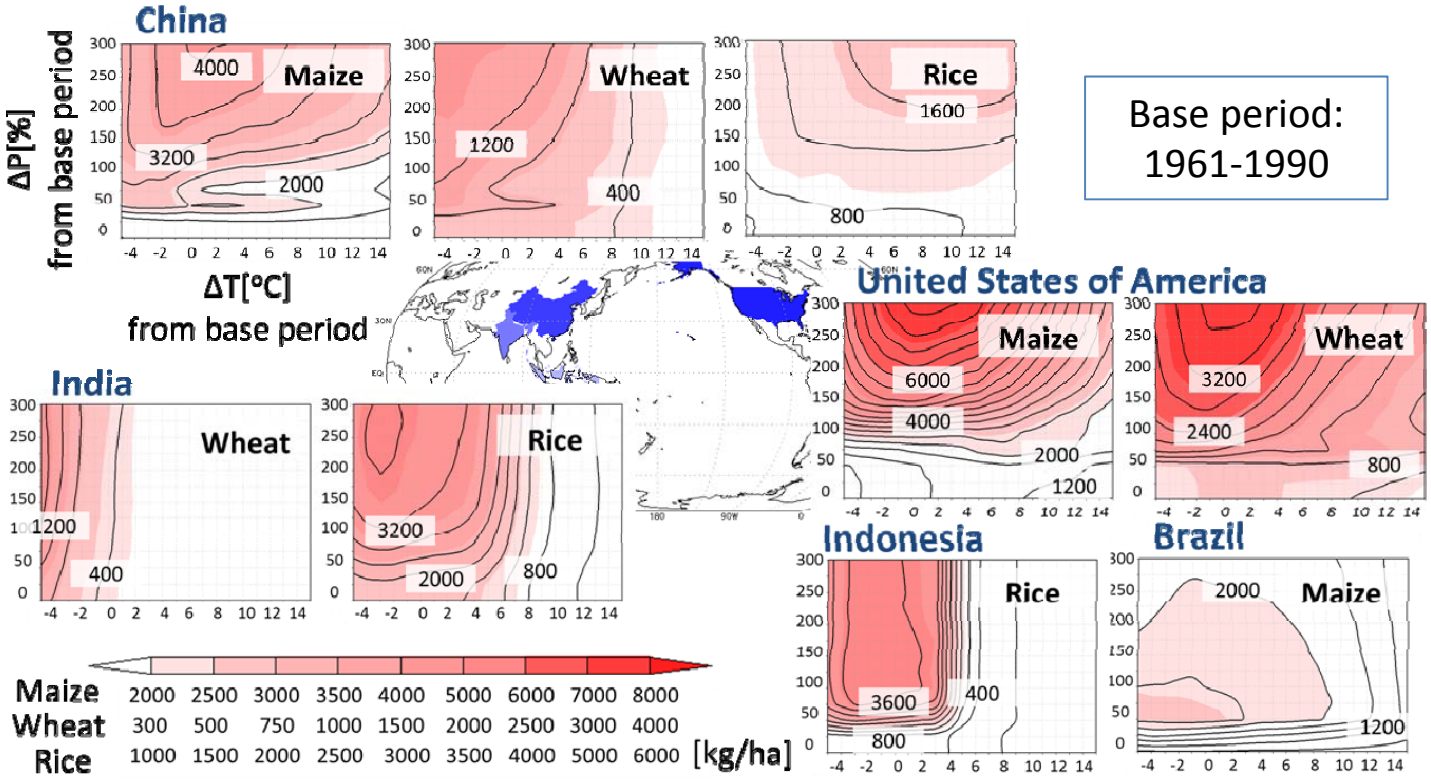
(3) Impact assessment





Impact Function development in AIM/Impact [Policy] (An example of Impact Function for crop productivity)

- The impact function is a look-up-table of country-averaged results of sensitivity analyses using a process-based detailed model.
- We developed an impact function for maize, wheat, and paddy-rice productivity with two explanatory variables, change in annual mean temperature (ΔT) and change in annual mean precipitation (ΔP), using the M-GAEZ model.



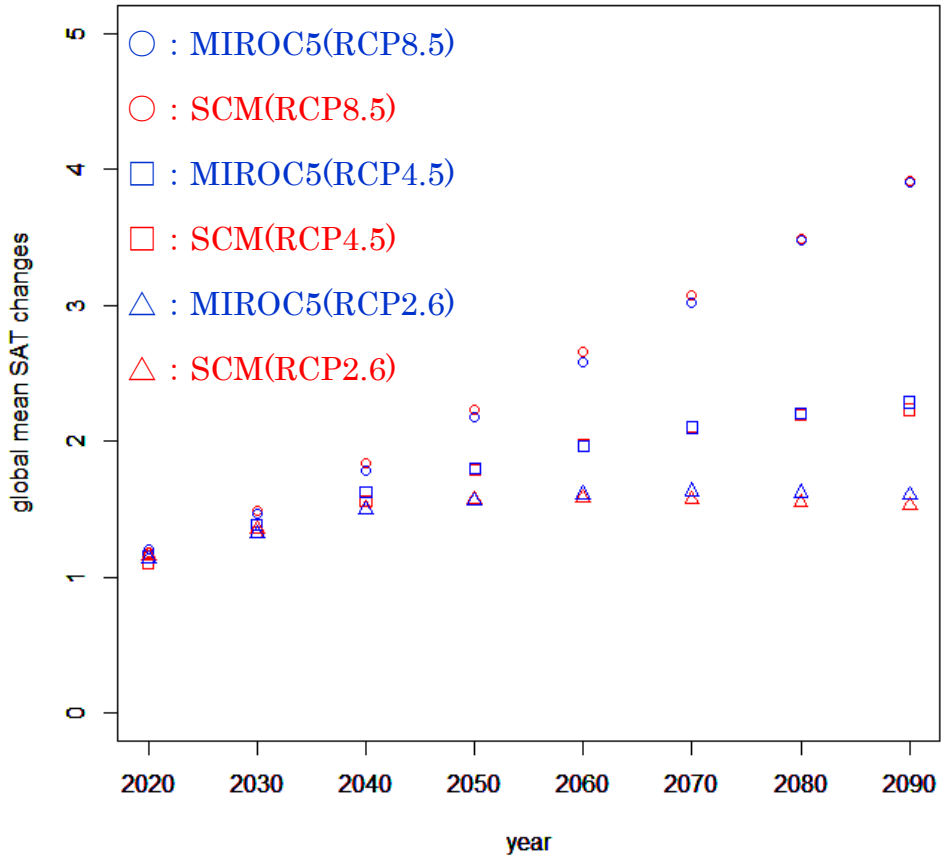
Tanaka et al.
(to be submitted)

Impact functions implemented in AIM/Impact[Policy]

- Country-wise (global)
  - Agriculture
    - Impact on potential productivity of rice, wheat and maize
  - Health
    - Change in heat stress mortality
  - Water resource
    - Change in renewable water resource
    - Falkenmark index (Water availability per capita)
- Prefecture-wise (Japan)
  - Agriculture
    - Impact on potential productivity of rice
  - Health
    - Change in heat stress mortality
  - Water resource / Hydrology
    - Slope disaster risk
    - Economic loss due to slope disasters
    - Economic loss due to flooding
  - Vegetation
    - Suitable habitat for Japanese beech
    - Pine wilt
  - Coastal area
    - Area of storm-surge flooding
    - Population at flood risk

Simple climate model (An example of emulations of MIROC5)

Ishizaki et al. (submitted to a Japanese Journal)



RCP8.5
RMSE=0.05

RCP4.5
RMSE=0.04

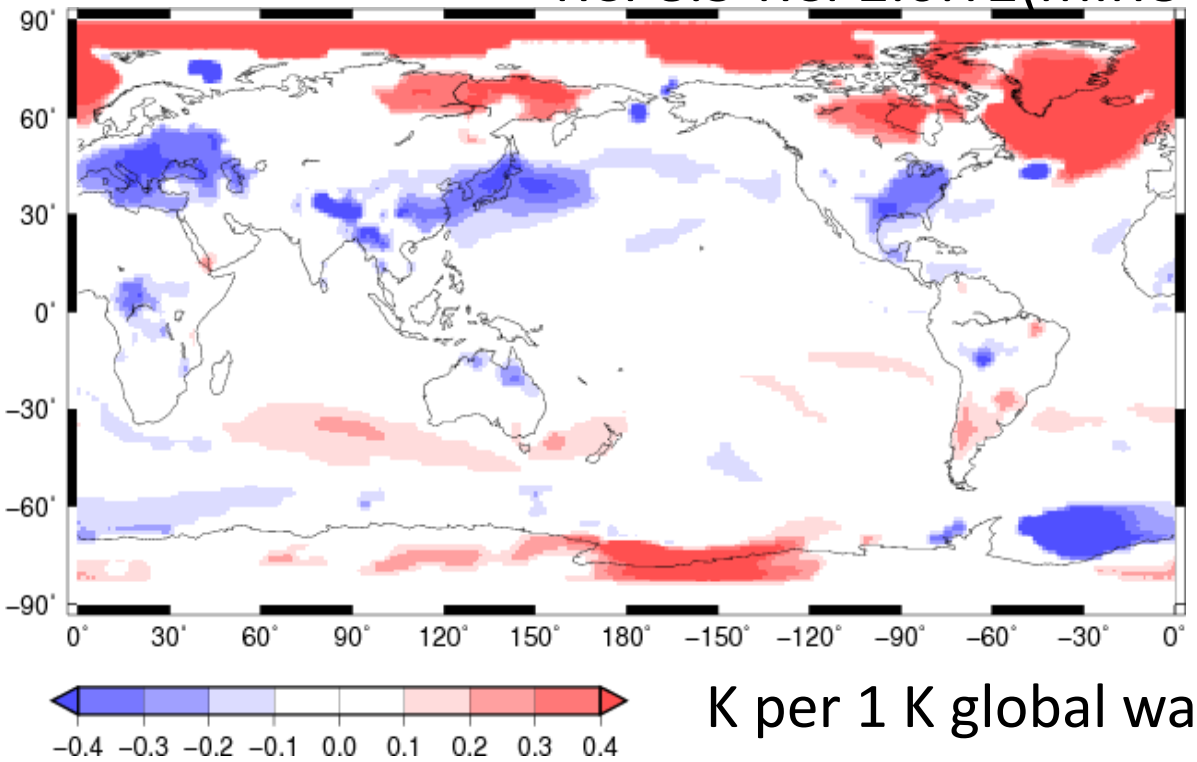
RCP2.6
RMSE=0.05

- We developed a simple climate model based on MAGICC 6.
- Our simple climate model (SCM) can successfully emulate the results of MIROC5 in RCPs.

Applicability check of pattern scaling method

Ishizaki et al. (2012) Climatic Change Letter, 112 (2), 535-546

RCP8.5-RCP2.6:T2(MIROC5,annual)



K per 1 K global warming

- Significant dependencies are shown over mid- and high latitude of the Northern hemisphere.
- The dependencies are mainly due to sulphate aerosol loading and non-linear response of sea ice melting to global warming.

Future challenges

- Wider development of Impact Functions based on the collaboration with the research teams in ICA-RUS Themes 2 and 3.
- Analyses using the AIM/Impact[Policy] for providing intermediate results to the ICA-RUS interim risk management strategy published in 2015 Spring.
- Further improvement of AIM/Impact[Policy] based on user needs collected by the communication sub-themes.